



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/626,330	07/24/2003	David J. Christie	AE2002-006CIP	1361
35487	7590	06/08/2005	EXAMINER	
JOHN D. PIRNOT ADVANCED ENERGY INDUSTRIES, INC. 1625 SHARP POINT DR. FORT COLLINS, CO 80525			MCDONALD, RODNEY GLENN	
			ART UNIT	PAPER NUMBER
			1753	

DATE MAILED: 06/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/626,330	CHRISTIE, DAVID J.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>7-24-03</u> . | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3, 5, 8, 9 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Sellers (U.S. Pat. 5,810,982).

Regarding claim 1, Sellers teaches sputtering with little or no damage to the target and without arcing. (Column 9 lines 30-33) Sellers technique permits a reactive sputtering operation to run as close as possible to the high end of the superglow region, which maximizes deposition rates without risk of encountering arc discharge conditions. (Column 9 lines 36-39) The process for depositing includes providing a plasma chamber with a sputtering gas disposed therein such as argon and oxygen. (Column 5 lines 27-32; Column 6 lines 54) A target 16 or cathode is provided to be sputtered. (Column 5 line 33) A DC voltage pulse is applied to the material of the target to affect sputtering as shown in Fig. 11. (Column 8 lines 50-60) The sputtering operates in a superglow region without encountering arc discharge. The superglow is "highly" ionized. (Column 9 lines 36-39) A film deposits on substrate 24. (Column 5 lines 39-41)

Regarding claim 3, Sellers the voltage rise time is controlled to be instant and operates in the superglow region. (See Fig. 11; Column 9 lines 36-39)

Art Unit: 1753

Regarding claim 5, Sellers the magnitude of the voltage pulse is limited by the controllable power supply 42 controllable to a magnitude between 50 volts and 300 volts. (Column 10 lines 22-25)

Regarding 8, Sellers teach a plasma chamber with a sputter gas disposed therein. (Column 5 lines 27-32; Column 6 lines 54) A target 16 or cathode is provided to be sputtered. (Column 5 lines 33) A DC voltage pulse source supply is provide that periodically applies a voltage pulse to the material target. (Column 10 lines 1-19) Pulse shaping circuitry is provided in the form of a pulse-width and pulse-rate control circuit 52 which generates signals that actuate the switch 44 to create the reverse bias pulses of suitable duty cycle and pulse frequency. (Column 10 lines 20-22) (Here the pulse shape is the width of the pulse. (i.e. a small width = small shape; a large width = large shape).

Regarding claim 9, Sellers the pulse shaping circuitry control the rise time of the voltage to be instant. (Fig. 11)

Regarding claim 11, Sellers the magnitude of the voltage pulse is limited by the controllable power supply 42 controllable to a magnitude between 50 volts and 300 volts. (Column 10 lines 22-25)

Claims 1, 3, 5, 8, 9 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Gruen (U.S. Pat. 5,015,493).

Regarding claim 1, Gruen teach providing a sputtering apparatus with a vacuum chamber 1. (Column 3 lines 17-18) A sputtering gas is provided to the chamber. (Column 3 lines 27-29) A DC voltage pulse source is provided to provide a DC pulse to

Art Unit: 1753

the target. (Column 3 lines 34-35) The process operates in the abnormal glow discharge region 21 of Fig. 4. It does not go through the arc discharge region 23. The abnormal glow discharge is "highly" ionized. (Column 4 lines 31-46) A workpiece 5 accumulates the sputtered material. (Column 3 lines 37-40)

Regarding claim 3, Gruen the discharge operates in the abnormal glow region without going through the arc discharge region. (Column 4 lines 31-46) The rise time of the voltage pulse is instant. (See Fig. 5)

Regarding claim 5, Gruen the pulse DC source is limited in magnitude in a range of 200 volts to 800 volts. (Column 6 lines 34-36)

Regarding claim 8, Gruen teach a sputtering apparatus with a vacuum chamber 1. (Column 3 lines 17-18) A sputtering gas is provided to the chamber. (Column 3 lines 27-29) A DC voltage pulse source is provided to provide a DC pulse to the target. (Column 3 lines 34-35) The process operates in the abnormal glow discharge region 21 of Fig. 4. It does not go through the arc discharge region 23. The abnormal glow discharge is "highly" ionized. (Column 4 lines 31-46) A workpiece 5 accumulates the sputtered material. (Column 3 lines 37-40) Pulse shaping circuitry is present to control the duration of the pulse and shape of the pulse to be square. (Column 6 lines 27-33)

Regarding claim 9, Gruen the voltage rate of rise of the voltage pulse is controlled to be instant. (See Fig. 5)

Regarding claim 11, Gruen the magnitude of the voltage pulse is controlled by the DC pulse source to be between 200 to 800 volts. (Column 6 lines 34-36)

Art Unit: 1753

Claims 1-3, 5, 8, 9 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Kouznetsov et al. "A novel pulsed magnetron sputter technique utilizing very high target power densities", Surface and Coatings Technology 122 (1999) 290-293.

Regarding claims 1, Kouznetsov et al. teach providing a plasma chamber with a sputtering of argon therein. A material target of copper is provided. A DC pulsed power supply was applied to the target in order to ionize a significant amount of copper (about 70%). The copper is deposited on substrate holders. (See page 290, 291, 293)

Regarding claim 2, Kouznetsov et al. teach the DC pulse power delivers power pulses up to 2.4 MW and has target power densities of 0.6-2.8 kW/cm². (See Page 291)

Regarding claim 3, Kouznetsov et al. teach the voltage rate of rise of the voltage pulse applied to the target material is shown in Fig. 1. (See Fig. 1)

Regarding claim 5, Kouznetsov et al. teach the voltage is limited to a maximum of 2,000 V. (See Page 291)

Regarding claim 8, Kouznetsov et al. teach providing a plasma chamber with a sputtering of argon therein. A material target of copper is provided. A DC pulsed power supply was applied to the target in order to ionize a significant amount of copper (about 70%). The copper is deposited on substrate holders. (See page 290, 291, 293) The shape of the voltage pulse is controlled by the power supply by controlling the pulse width to be in a range of 50-100 microseconds. (See page 291)

Art Unit: 1753

Regarding claim 9, Kouznetsov et al. teach the pulse shaping controls the voltage rise time as seen in Fig. 1. (See Fig. 1)

Regarding claim 11, Kouznetsov et al. teach the voltage is limited to 2,000V.
(See page 291)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sellers (U.S. Pat. 5,810,982) or Gruen (U.S. Pat. 5,015,493) or Kouznetsov et al. "A novel pulsed magnetron sputter technique utilizing very high target power densities", Surface and Coatings Technology 122 (1999) 290-293 in view of Manley et al. (U.S. Pat. 5,682,067).

Sellers, Gruen or Kouznetsov et al. is discussed above and all is as applies above. (See Sellers, Gruen or Kouznetsov et al. discussed above)

The difference between Sellers, Gruen or Kouznetsov et al. and the present claims is that wherein the voltage rate of rise of the voltage pulse is controlled using a circuit comprising a resistor in series with a capacitor is not discussed, wherein the magnitude of the voltage pulse is limited using a circuit comprising a resistor in series with a capacitor and wherein the magnetic of the voltage pulse is limited using a circuit

Art Unit: 1753

comprising a reverse biased diode, a capacitor and a clamp voltage supply is not discussed.

Regarding the circuit comprising a resistor in series with a capacitor for controlling the voltage rate of rise of the voltage pulse, Manley et al. suggest capacitor 32 and resistor 38 for controlling the voltage. (Column 4 lines 3-16)

Regarding the circuit comprising a resistor in series with a capacitor for controlling the magnitude of the voltage pulse, Manley et al. suggest a capacitor 30 and diode 34 for limiting the voltage. (Column 4 lines 31-35)

Regarding the use of a circuit comprising a reverse biased diode, a capacitor and a clamp voltage supply for limiting the voltage, Manley suggest a capacitor 30, a diode 34 and clamping voltage (i.e +/-) for limiting voltage. (Column 4 lines 31-35; Column 11 lines 55-58)

The motivation for providing a circuit comprising a resistor in series with a capacitor for controlling the voltage rate of rise of the voltage pulse, for providing a circuit comprising a resistor in series with a capacitor for controlling the magnitude of the voltage pulse and for using a circuit comprising a reverse biased diode, a capacitor and a clamp voltage supply for limiting the voltage is that it allows for limiting the voltage applied to an electrode. (Column 4 lines 31-35)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Sellers, Gruen or Kouznetsov et al. by providing a circuit comprising a resistor in series with a capacitor for controlling the voltage rate of rise of the voltage pulse, for providing a circuit comprising a resistor in

Art Unit: 1753

series with a capacitor for controlling the magnitude of the voltage pulse and for using a circuit comprising a reverse biased diode, a capacitor and a clamp voltage supply for limiting the voltage as taught by Manley et al. because it allows for limiting the voltage applied to an electrode.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 8-12 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-7 of U.S. Patent No. 6,808,607 in view of Sellers (U.S. Pat. 5,810,982) or Gruen (U.S. Pat. 5,015,493) or Kouznetsov et al. "A novel pulsed magnetron sputter technique utilizing very high target power densities", *Surface and Coatings Technology* 122 (1999) 290-293.

Claims 1-7 of U.S. Pat. No. 6,808,607 teach a plasma chamber, a material target, a DC pulsed power supply, and a pulsing circuit with pulse shaping means.

(Claims 1-7)

Art Unit: 1753

The differences between U.S. Pat. No. 6,808,607 and the present claims is that the ionizing without first adopting an arc discharge state is not discussed.

Sellers, Gruen or Kouznetsov et al. are discussed above and suggest operating pulse devices without adopting an arc discharge state. (See Sellers, Gruen, or Kouznetsov et al. discussed above)

The motivation for operating pulse devices without adopting an arc discharge state is that it allows for eliminating arcing. (See Sellers, Gruen or Kouznetsov et al. discussed above)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified U.S. Pat. No. 6,808,607 by operating such that an arc discharge state is not adopted as taught by Sellers, Gruen or Kouznetsov et al. because it allows for eliminating arcing.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1753

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
June 1, 2004